Staple Punch Finisher

Theory Of Operation

Description of mechanism and operation

1. Outline of operation

Product Name TBD transmits and receives signals over a host machine and serial communication, and executes the following 8 operational modes.

1-1 Straight

Ejects paper to the upper tray.

1-2 Punch + Straight

Makes a punch hole on paper with the end holder, then ejects it to the upper tray.

1-3 Invert

Ejects paper inversely to the lower tray via the middle stack part.

1-4 Punch + Invert

Makes a punch hole on paper with the end holder, then ejects it inversely to the lower tray via the middle stack part.

1-5 Invert + Staple

Jogs paper every sheet at the middle stack part, and staples them when the sheet reaches at assigned number, then ejects it inversely to the lower tray.

1-6 Punch + Invert + Staple

Makes a punch hole on paper with the end holder, and jogs every sheet at the middle stack part, then staples them when the sheet reaches at assigned number, and then ejects it inversely to the lower tray.

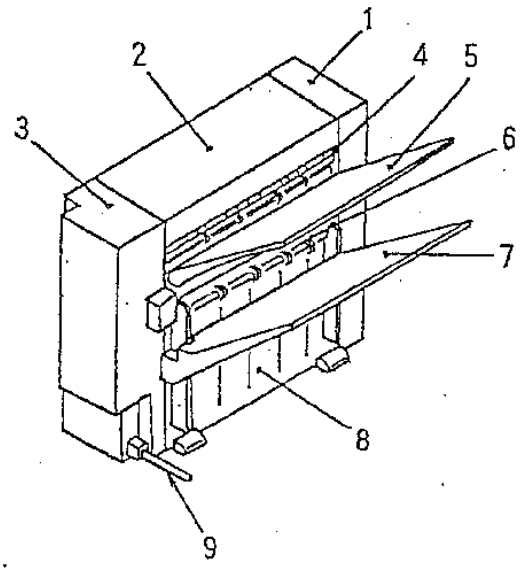
1-7 Invert + Offset

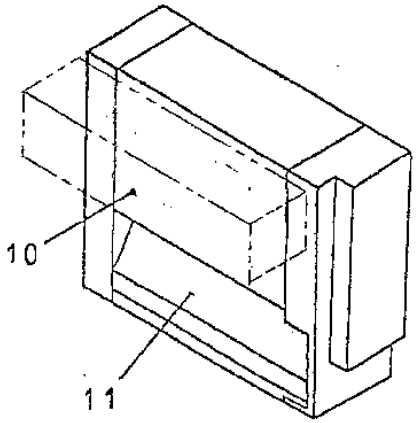
After jogging paper every sheet at the middle stack part and operating offset, ejects it inversely to the lower tray.

1-8 Punch + Invert + Offset

After making a punch hole on paper with the end holder, jogging every sheet at the middle stack part, and offsetting, ejects it to the lower tray.

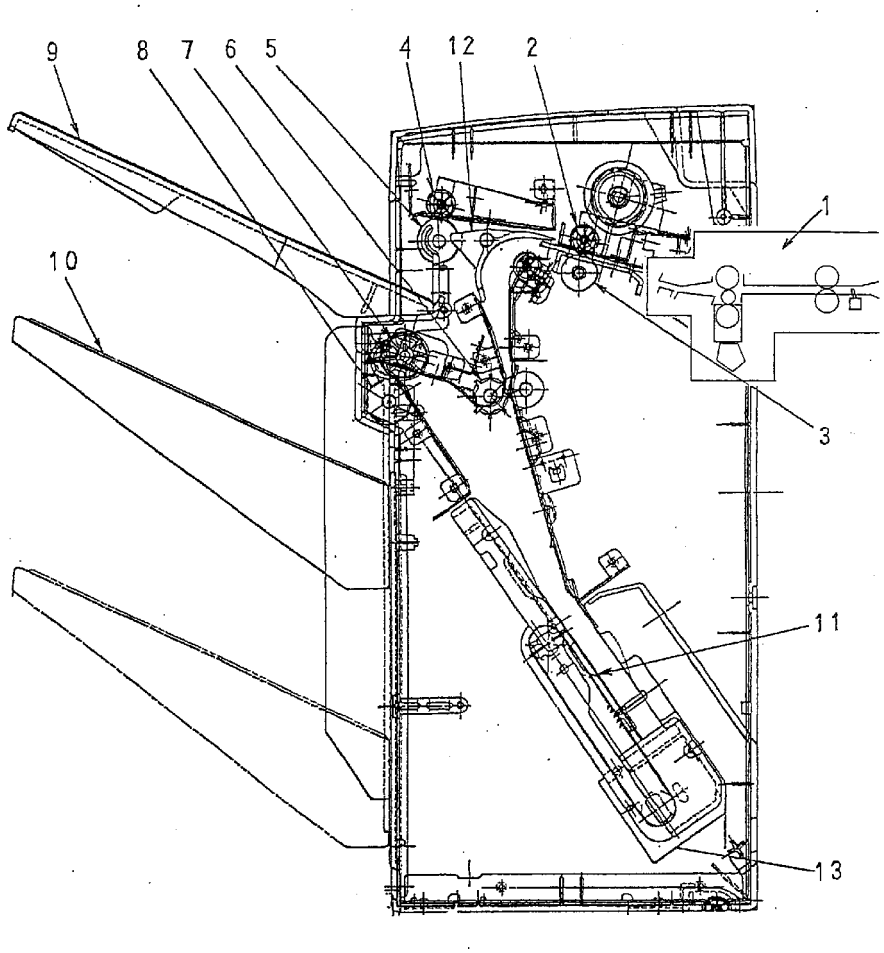
2. Outside drawing





1. Cover (F)
2. Cover (T)
3. Cover (R)
4. Paper ejection port (straight)
5. Upper tray
6. Paper ejection port (invert)
7. Lower tray
8. Left panel (lower)
9. I/F cable
10. Transport unit
11. Cover stapler

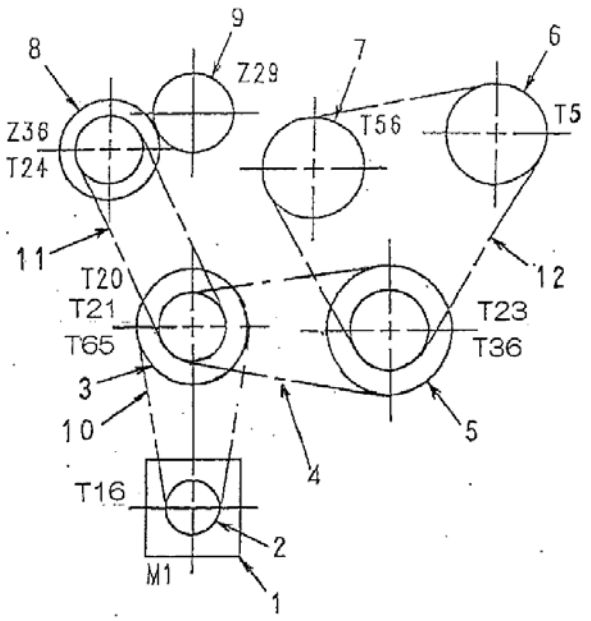
3. Sectional view



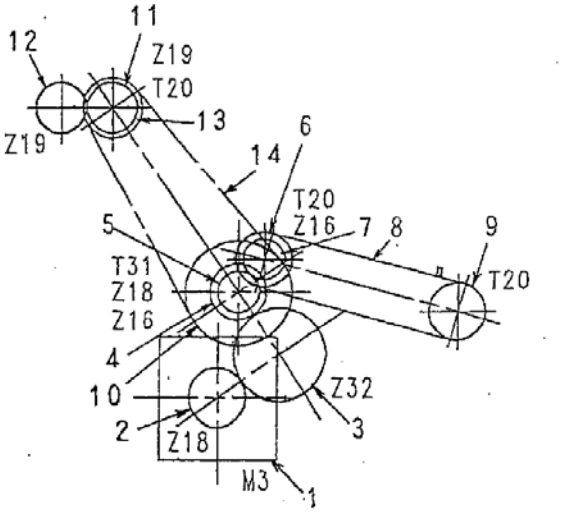
1. Transport unit
2. Resist koro
3. Resist roller
4. Straight ejection koro
5. Straight ejection roller
6. Paddle roller
7. Invert ejection koro
8. Invert ejection roller
9. Upper tray
10. Lower tray
11. Middle stack part
12. Path selecting gate
13. Stapler unit

4. Driving related part

Carrier 1
1. Carrier motor
2. Carrier motor pulley
3. Carrier pulley
4. Timing belt
5. Invert carrier gear pulley
6. Straight ejection pulley
7. Resist pulley
8. Punch driving gear pulley
9. Punch gear
10. Timing belt
11. Timing belt
12. Timing belt

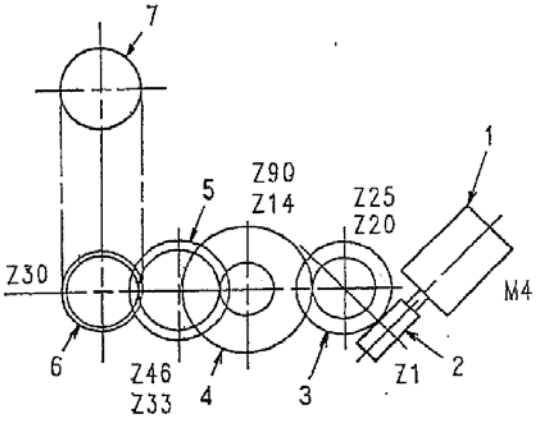


Carrier 2
1. Belt motor
2. Tractor motor gear
3. Gear
4. Gear
5. Gear
6. Belt pulley
7. Belt gear
8. Timing belt
9. Belt pulley
10. Ejection pulley
11. Gear
12. Ejection gear
13. Pulley
14. Timing belt

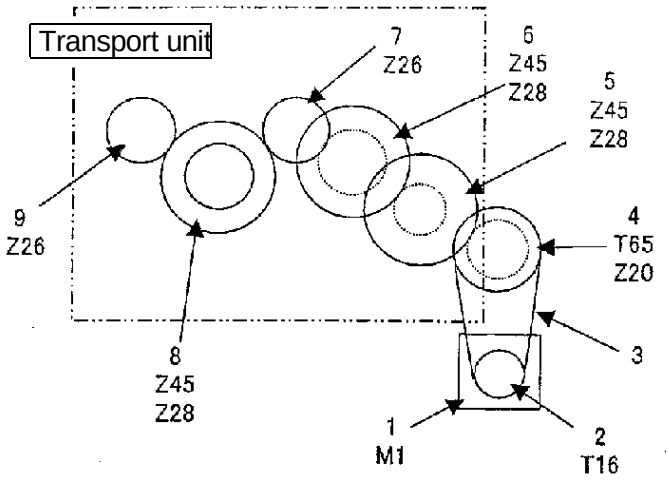


Carrier 3
1. Elevation motor
2. Elevation gear
3. Gear

4. Gear
5. Gear
6. Gear
7. Wire drum

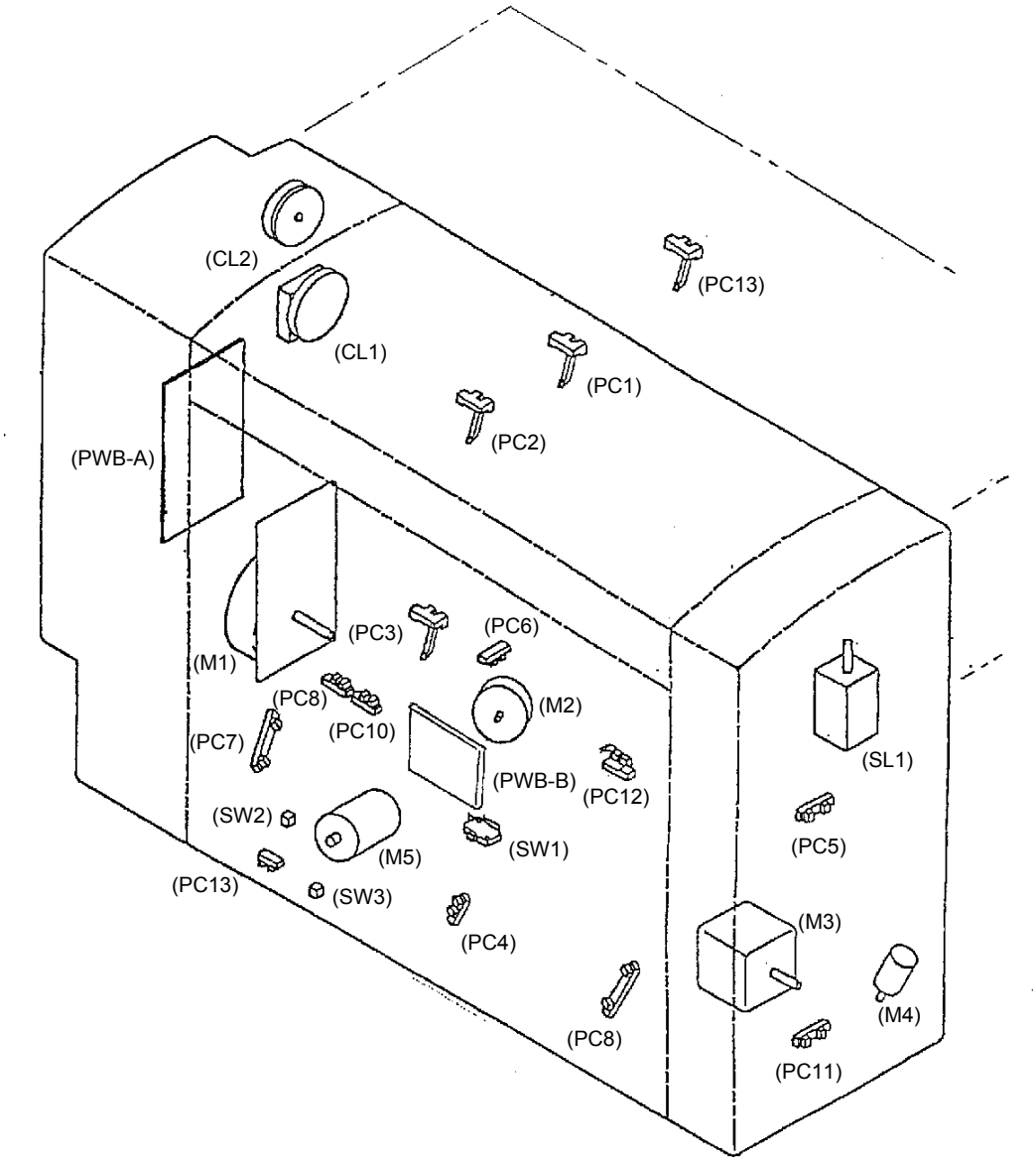


Carrier 4
1. Carrier motor
2. Carrier motor pulley
3. Timing belt
4. Carrier pulley/gear
5. Gear
6. Gear
7. Decurl roll gear
8. Gear
9. Input carrier gear



5. Electrical components

5-1. Electrical components layout drawing



Mark	Name	Mark	Name
M1	Carrier motor	PC7	Sheet detecting sensor
M2	Jogging motor	PC8	Paper path sensor
M3	Belt motor	PC9	Paper full detecting sensor
M4	Elevation motor	PC10	Paper top face detecting sensor
M5	Staple motor	PC11	Elevation lower limit sensor
SL1	Gate solenoid	PC12	Punch box detecting sensor
CL1	Punch resist clutch	PC13	Carrier sensor
CL2	Punch clutch	SE1	Staple home position sensor
PC1	Resist sensor	SW1	Set switch
PC2	Ejection sensor(straight)	SW2	Cartridge sensor
PC3	Ejection sensor(invert)	SW3	Staple sensor
PC4	Belt home position sensor	PWB-A	Control board
PC5	Elevation upper limit sensor	PWB-B	Power supply board
PC6	Jogging home position sensor		

5-2. Electrical components(operation related to the switch and the sensors)

1. Set switch (SW1)
   Detects the finisher set state and resets paper stuck.
2. Cartridge sensor (SW2)
   Detects presence/absence of the staple cartridge.
3. Staple sensor (SW3)
   Detects absence of staples.
4. Staple home position sensor (SE1)
   Detects the home position of the staple.
5. Resist sensor (PC1)
   Detects the paper drawn in the finisher and paper stuck.
   Detects trigger for punching operation.
6. Paper path sensor (LTR)(PC2)
   Paper path sensor (A4) (PC8)
   Detects the paper drawn in the stack tray.
   Detects the end of paper jogging
   Detects paper stuck.
7. Ejection sensor (invert) (PC3)
   Detects paper ejection.
8. Belt home position sensor(PC4)
   Detects the home position of the belt.
9. Elevation upper limit sensor(PC5)
   Detects upper limit of the lower tray.
10. Jogging home position sensor(PC6)
   Detects the home position of the jogging bar.
11. Sheet detecting sensor (PC7)
   Detects that paper is jogged to the position enable to be stapled.
12. Paper full detecting sensor(PC9)
   Detects that paper on the lower tray is loaded to the specified position.
13. Paper top face detecting sensor(PC10)
   Detects top face of paper on the lower tray.
   Detects that paper on the lower tray is removed during stacking.
14. Elevation lower limit sensor(PC11)
   Detects lower limit of the lower tray.
15. Carrier sensor (PC13)
   Detects the paper drawn in the transport unit and paper stuck.

6. Paper carrier mechanism

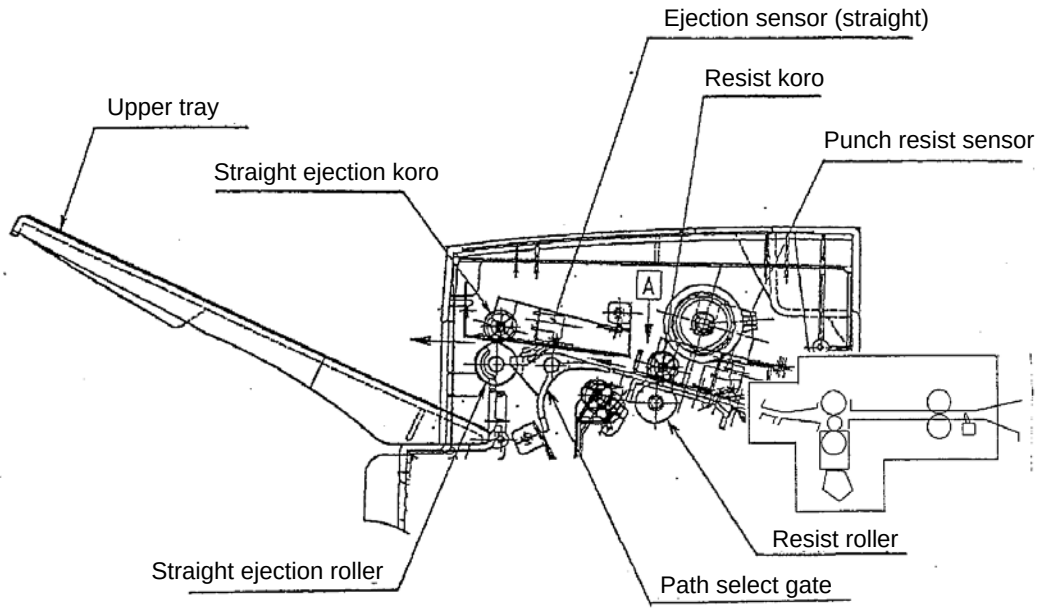
6-1 Paper carrier mechanism

Paper carrier of [Product Name TBD] is carried out by detecting paper with the punch resist sensor, and by rotating each roller through each driving gear and belt by driving the carrier motor(M1) and its belt motor(M3), etc.

Different carrier path is used depending on the mode selected.

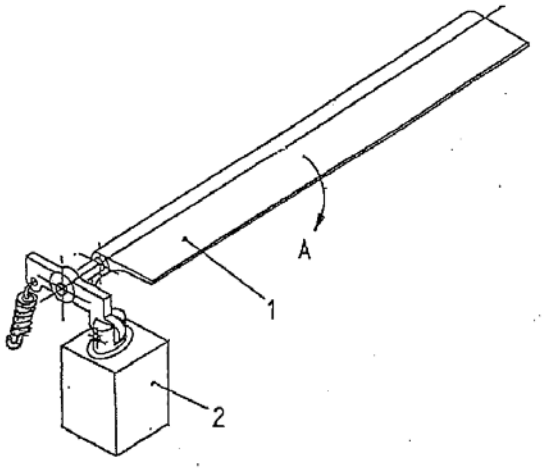
(1) Straight path (Ejects to the upper tray)

By driving the carrier motor(M1), each roller starts rotating. When the paper carrier sensor detects paper, the path select gate is switched in the direction of A arrow by the gate solenoid, and paper will be ejected to the upper tray by the carrier roller.



(Carrier switching mechanism)

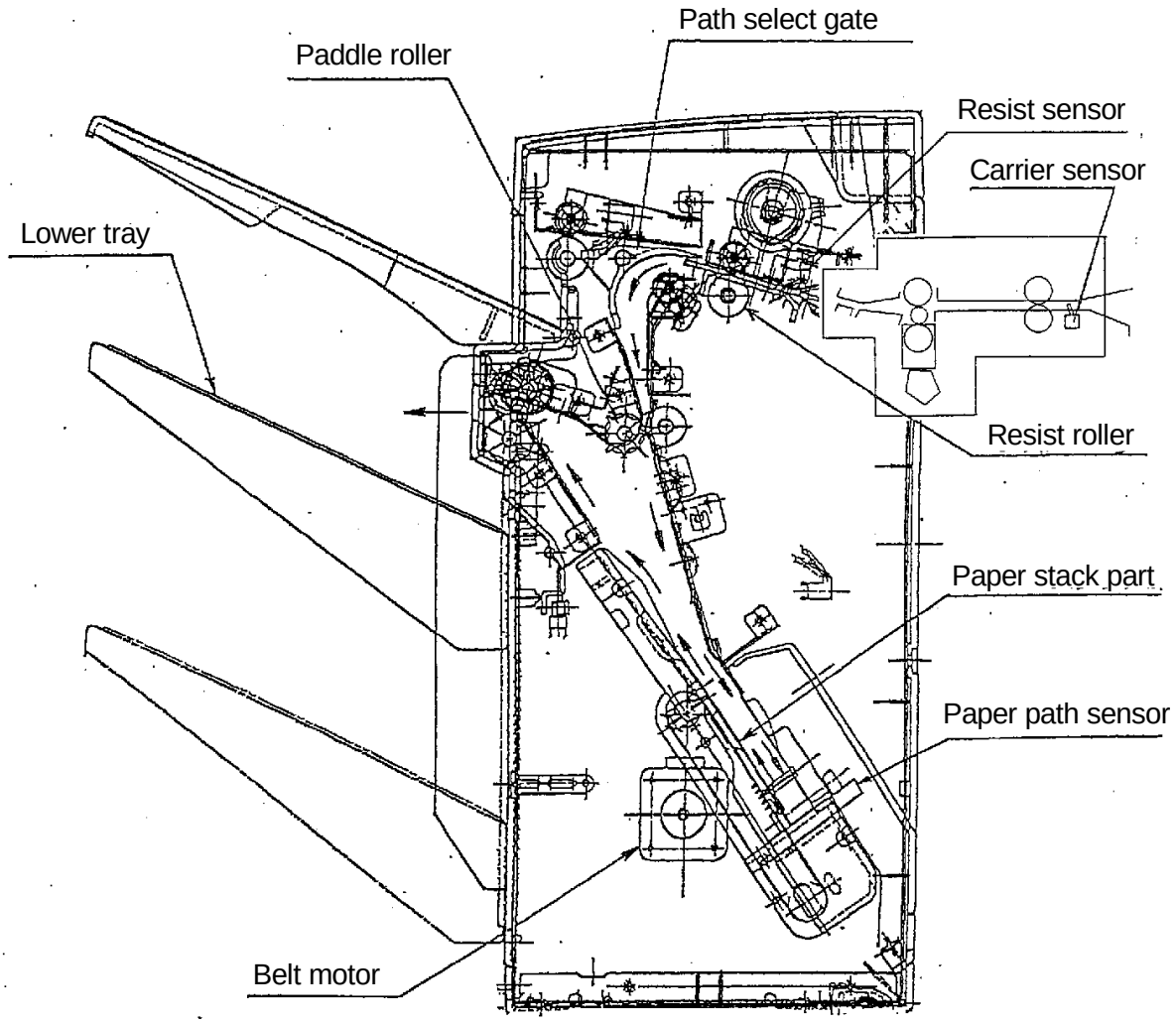
1. Path select gate
2. Gate solenoid Path select gate



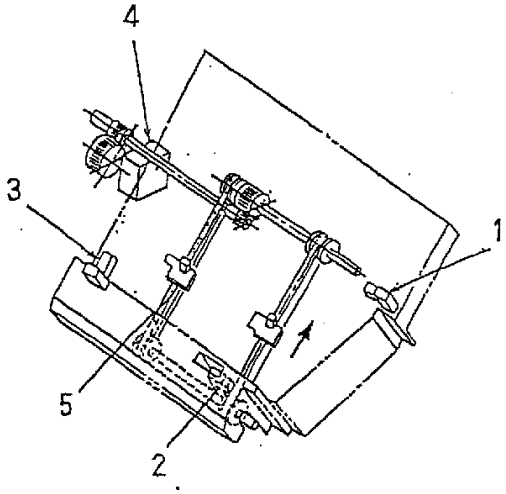
6-2 Paper carrier mechanism (Middle stack part)

(1) Invert (Ejects to the lower tray)

By driving the carrier motor(M1), each roller starts rotating. After passing through the resist roller, the path select gate and the paddle roller, the paper is detected by the paper path sensor which draws the paper in the stack part. Next, the paper will be jogged, and the belt motor will activate, and then the paper will be ejected to the lower tray.

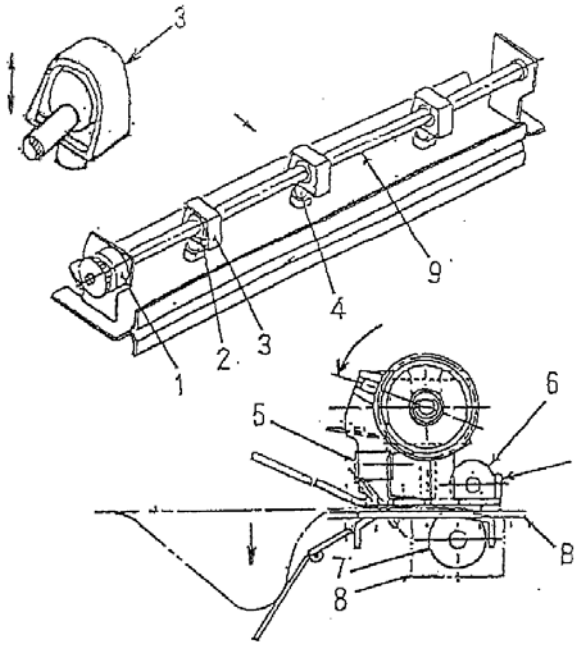


Paper stack part
1. Sheet detecting sensor
2. Belt home position sensor
3. Paper path sensor
4. Belt motor
5. Belt



7. Punching mechanism

1. Punch clutch (CL2)
2. Eccentric cam
3. Cam lifter
4. Punch bar
5. Paper carrier sensor
6. Resist koro
7. Resist roller
8. Punch resist clutch (CL1)
9. Driving shaft



(1) Paper carrier stop mechanism

Stops the paper during carrying at the punching position in a moment.

Operation

Paper is carried in TDB, and the paper end passes through the paper carrier sensor.

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· The punch resist clutch(CL1) turns "ON".
Because CL1 is normally closed, driving force is not conveyed to the resist roller by turning "ON", thus it cause to stop carrying paper at the resist roller part.

· Because paper carrying from the printer main body is continuing, the paper end is pushed against the nip of the resist roller and is positioned. At this time, paper loop is generated at the carrier part. To permit this loop, the mechanism is designed for the guide board to be released in a downward by the spring as shown in the figure.

· Makes punch hole on the end of the paper by the punch unit.

↓

· CL1 turns "OFF" and this is also conveyed to the resist roller for the paper to be carried.

(2) Driving mechanism of the punch unit

The punch unit consists of guide A,B, punch bar, eccentric cam, driving shaft and one revolution punch clutch(CL2).

(3) Drive of the punch unit

When the carrier motor activates, the clutch gear part of the punch unit starts rotating through the punch unit driving gear. However, the punch clutch(CL2) is usually "OFF", thus it is locked and revolution cannot be conveyed to the driving shaft.

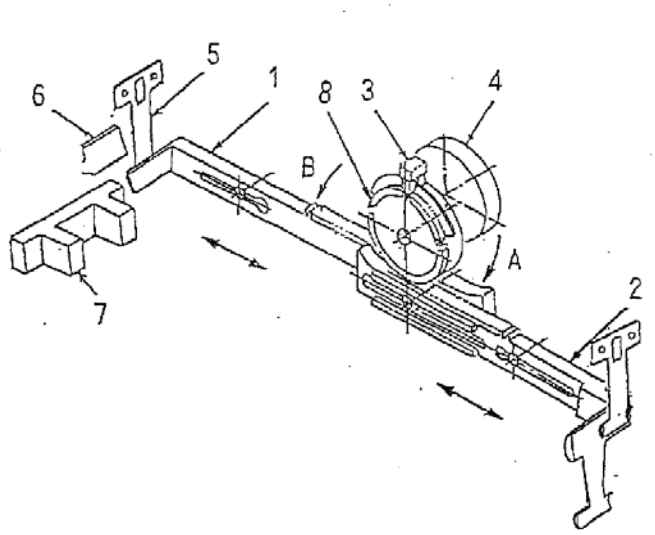
When CL2 turns "ON", the lock will be unhooked, so revolution of the clutch gear part will be conveyed to the driving shaft to rotate.

(CL2) is made to be "ON" in a moment and the punch clutch rotates once, then it is locked again to stop the driving shaft.

When the driving shaft rotates once, the punch bar will be pushed by the eccentric cam and reciprocated up and down once to make a punch hole on the paper.

8. Jogging offset mechanism

1. Offset bar (rack B)
2. Jogging bar (rack A)
3. Jogging home position sensor
4. Jogging motor
5. Presser spring
6. Reference board
7. Sheet detecting sensor
8. Pinion gear



<Jogging operation>

· Moves the paper housed in the middle stack part to the reference board by the jogging bar and jogs it in the direction of STS. The sheet detecting sensor detects that the paper is jogged to the position enable to be stapled.
By doing this, it is possible to staple under the condition that paper is in good order when the stapling operation.
Moreover, paper is carried at the position where the paper is touched to the reference board when it is ejected, thus it is possible to eject the paper to the home position.

<Offset operation>

· To offset the paper jogged in the direction of STS, single and multiple paper or staples are offset by the offset bar. Then the paper will be ejected separately and sorted.

<Mechanism of jogging offset>

· The jogging and the offset bar rotate each jogging motor(M2) and gear in the direction of A and B, and moves the jogging bar and the offset bar by the rack pinion.
· To ensure the interlocking of the rack and the pinion, the presser spring presses the rack against the pinion side.
Amount of shifting the jogging bar differs depending on paper size. (A4 and LTR only)

<Detection of home position>

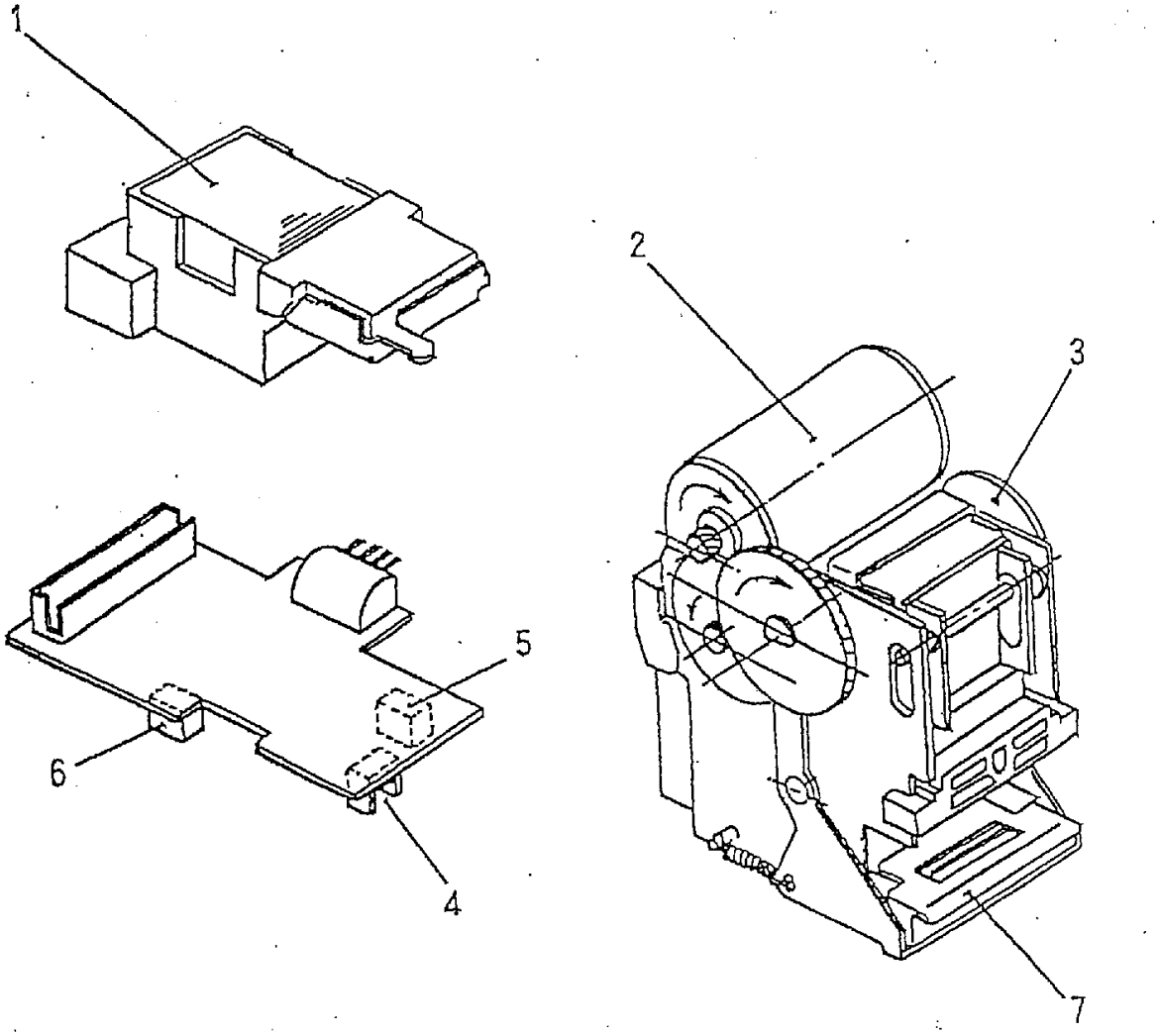
· Detection of home position of the jogging bar is carried out by the shielding board and the jogging home position sensor united with the pinion.
· Home position of the jogging bar is the position immediately after the condition of sensor light changes from transparency to shielding by the shielding board.
· Having this position as a reference, shifting of the jogging bar and the offset bar for each paper size is calculated.

9. Staple mechanism 1

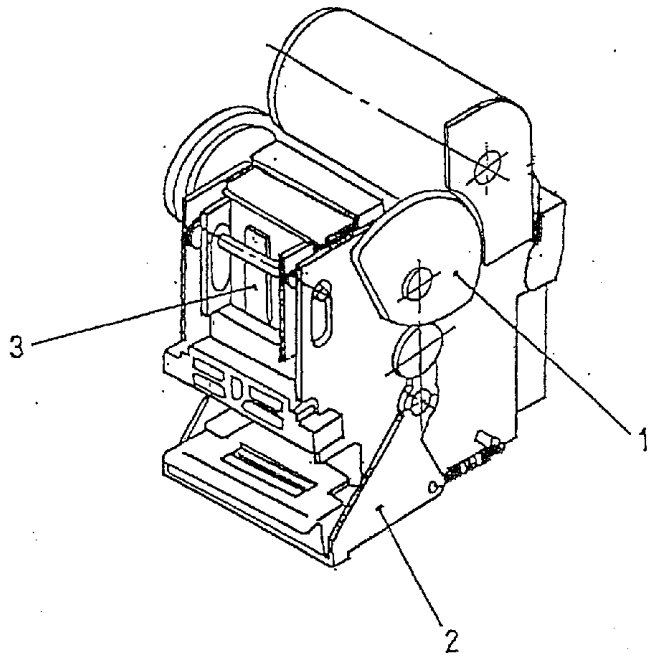
1. Staple cartridge
2. Staple motor
3. Eccentric cam
4. Staple home position sensor
5. Staple sensor
6. Cartridge sensor
7. Staple table

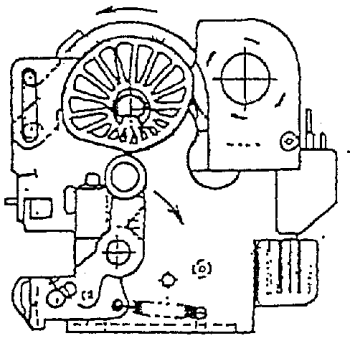
· Drive of the stapler is made by revolution of the staple motor and this revolution rotates the eccentric cam through the gear.

· The link touches with the eccentric cam. By rotating the eccentric cam, the link starts operating circular motion with the supporting point as center.



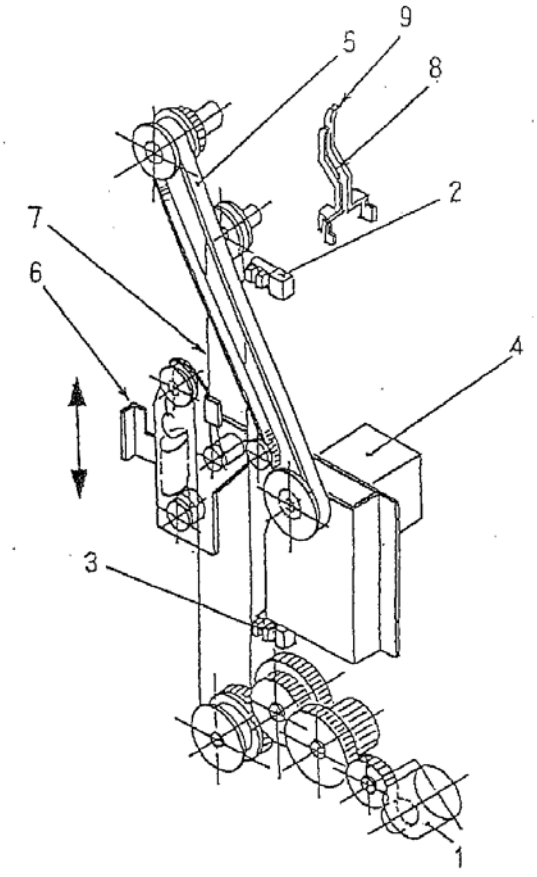
Staple mechanism 2
1. Eccentric cam
2. Staple table
3. Staple plate





10, Elevation mechanism

1. Elevation motor
2. Elevation upper limit sensor
3. Elevation lower limit sensor
4. Belt motor
5. Belt
6. Hook plate
7. Wire
8. Paper top face detecting sensor
9. Paper full detecting sensor



By driving the elevation motor, when the wire drum is rotated, the wire is wound and the lower tray moves up and down by up and down movement of the hook plate.

(1) Up/down control of the lower tray

1) By driving the elevation motor(M4), the lower tray
   · elevates until it detects the elevation upper limit sensor or the paper top face detecting sensor.
   · If there is paper on the tray, elevates until it detects the paper top face detecting sensor,
   · and if there is not, elevates until it detects the elevation upper limit sensor.
   · When detecting the elevation upper limit sensor, transmits to the host that the tray is empty.

2) Several sheets are ejected and the lower tray detects the paper full detecting sensor. After that, the lower tray moves down and stops at the position that the paper full detecting sensor is not detected anymore.

3) When paper is loaded on the lower tray, and the elevation lower limit sensor and the paper top face detecting sensor are detected, printer ejection will be prohibited.

4) When the paper on the lower tray is removed and the paper top face sensor is no more detected, the lower tray will be elevated.